What is claimed is:

1 1: A method comprising:

2   receiving a packet;

3   applying an Active Rule to the received Packet;

4   accessing a cached Condition Set Table, having at least one Condition Set,

5 associated with the Active Rule;

6   for each Condition Set, having at least one Condition, in the Condition Set Table,

7   evaluating the Condition(s) in the Condition Set, and

8   determining if the Condition Set is met;

9   determining if the Active Rule is met; and

10   executing an Action Set associated with the Active Rule.

1 2: The method of claim 1, wherein applying an Active Rule to the received Packet

2 includes:

3   parsing a cached Rules Tables, having a plurality of rules, to determine if a rule is

4 pertinent to the received packet;

5   if so, making the pertinent rule the Active Rule.

1 3: The method of claim 2, wherein applying an Active Rule to the received Packet

2 includes:

3   if more than one rule in the Rules Table is pertinent, performing the method of

4 claim 1 for each pertinent rule.

1   4: The method of claim 2, wherein the received packet includes a source, a destination,

2   and a protocol;

3   wherein the rules in the Rules Table includes a source, a destination, and a

4   protocol; and

5   wherein determining if a rule is pertinent to the received packet includes:

6   determining if the source of the received packet and the source of the rule are equivalent;

7   determining if the destination of the received packet and the destination of the rule are

8   equivalent;

9   determining if the protocol of the received packet and the protocol of the rule are

10 equivalent;

11 if all three are equivalent, considering the rule pertinent to the received packet.

1   5: The method of claim 2, wherein applying an Active Rule to the received Packet

2   includes:

3   selecting a rule from a Rules Table, having at least one rule; and

4   accessing a Rule Group from a Rules Group Table;

5   wherein the Rule Group includes a field to facilitate access to the first Condition Set

6   associated with the rule, and a field to facilitate access to the first Action Set associated

7   with the rule.

1   6: The method of claim 5, wherein accessing a cached Condition Set Table includes:

2   accessing the Condition Set Tables utilizing the Rule Group's field to facilitate

3   access to the first Condition Set associated with the rule.

1   7: The method of claim 1, wherein each of the at least one Conditions includes pattern,

2   and an opcode; and

3   wherein evaluating the Condition(s) in the Condition Set includes:

4   for each Condition,

5   comparing the pattern to the received packet in the manner dictated by the

6   opcode, and

7   producing a Boolean value as a result of the comparison; an

8   wherein determining if the Condition Set is met includes:

9   computing a single Boolean value utilizing the Boolean values resulting from

10 evaluating the Condition(s).

1   8: The method of claim 7, wherein each of the at least one Conditions further includes at

2   least one of the fields selected from a group including of the following:

3   a bit offset where the pattern is to be found,

4   a pattern mask to alter interpretation of the pattern,

5   a mask value to alter interpretation of received packet, and

6   a pattern length.

1   9: The method of claim 7, wherein each of the at least one Conditions further includes a

2   flag to denote that the Condition has already been evaluated for the current received

3   packet, and a value denoting the result of that evaluation.

1   10: The method of claim 7, wherein computing a single Boolean value utilizing the

2   Boolean values resulting from evaluating the Condition(s) includes:

3   utilizing a 1-bit Condition Accumulator to logically AND, as each Condition's

4   Boolean value is computed, the Boolean values resulting from evaluating the

5   Condition(s).

1   11: The method of claim 7, wherein determining if the Active Rule is met includes:

2   computing a single Boolean value utilizing the Boolean values resulting from

3   determining if the Condition Set is met.

1   12: The method of claim 11, wherein computing a single Boolean value utilizing the

2   Boolean values resulting from determining if the Condition Set is met includes:

3   utilizing a 1-bit Condition Set Accumulator to logically OR, as each Condition

4   Set's Boolean value is computed, the Boolean values resulting from determining if the

5   Condition Set is met.

1   13: The method of claim 6, wherein evaluating the Condition(s) in the Condition Set

2   includes:

3   utilizing the Condition Set Table to access a Condition Indirection Table, having a

4   pointer to each Condition, wherein the pointers are grouped by Condition Set; and

5   utilizing the pointers to access a Condition Table having the Conditions.

1   14. The method of claim 13, wherein any Condition may be included by a plurality of

2   Condition Sets.

1   15. The method of claim 13, wherein the Condition Indirection Table is stored within a

2   Content Addressable Memory (CAM).

1   16. The method of claim 1, wherein executing an Action Set associated with the Active

2   Rule includes:

3   accessing an Action Set having at least one Action; and

4   executing each Action within the Action Set.

1   17. The method of claim 16, wherein executing each Action includes performing one of

2   the Actions selected from a group including the following:

3 altering the packet header,

4 altering the packet contents,

5 reporting information to a third party, and

6 changing the priority status of the packet.

1 18. The method of claim 16, wherein accessing an Action Set having at least one Action

2 includes:

3 accessing a Rule Group having a pointer to the Action Set;

4 accessing an Action Set Table having a plurality of Action Sets; and

5 selecting an Action Set from the Action Set Table.

1 19. The method of claim 1, wherein the number of Conditions in a Condition Set is

2 limited, at least in part, by the amount of information that can be read from a cache

3 memory in one clock cycle.

1 20. The method of claim 1, wherein the number of Actions in an Action Set is limited, at

2 least in part, by the amount of information that can be read from a cache memory in one

3 clock cycle.

1 21. An apparatus comprising:

2 a micro-engine having a rule based action packet processing engine that is capable

3 of processing a received packet;

4 a network processor core that is capable of resource management and control of

5 the micro-engine;

6 a packet buffer to receive a packet; and

7 a cache memory to store data structures for the micro-engine.

1 22. The apparatus of claim 21, further including a plurality of micro-engines to process a

2 plurality of received packets substantial simultaneously.

1 23. The apparatus of claim 21, wherein the micro-engine includes:

2 an ingress packet processing engine to receive a packet;

3 an egress packet processing engine to forward a processed packet; and

4 a Rule Based Action Packet Processing Engine that is capable of:

5 applying an Active Rule to the received Packet;

6 accessing a cached Condition Set Table, having at least one Condition Set, associated

7 with the Active Rule;

8 for each Condition Set, having at least one Condition, in the Condition Set Table,

9 evaluating the Condition(s) in the Condition Set, and

10 determining if the Condition Set is met;

11   determining if the Active Rule is met; and

12   executing an Action Set associated with the Active Rule.

1   24. The apparatus of claim 23, wherein the Rule Based Action Packet Processing

2   Engine's capability to apply an Active Rule to the received Packet includes the capability

3   to:

4   parse a cached Rules Tables, having a plurality of rules, to determine if a rule is

5   pertinent to the received packet;

6   if so, make the pertinent rule the Active Rule.

1   25. The apparatus of claim 24, wherein the received packet includes a source, a

2   destination, and a protocol;

3   wherein the rules in the Rules Table includes a source, a destination, and a

4   protocol; and

5   wherein the Rule Based Action Packet Processing Engine's is capable of:

6   determining if the source of the received packet and the source of the rule are equivalent;

7   determining if the destination of the received packet and the destination of the rule are

8   equivalent;

9   determining if the protocol of the received packet and the protocol of the rule are

10   equivalent;

11   if all three are equivalent, considering the rule pertinent to the received packet.

1   26: The apparatus of claim 24, wherein the Rule Based Action Packet Processing

2   Engine's is capable of, when applying an Active Rule to the received Packet:

3   selecting a rule from a Rules Table, having at least one rule; and

4   accessing a Rule Group from a Rules Group Table;

5   wherein the Rule Group includes a field to facilitate access to the first Condition Set

6   associated with the rule, and a field to facilitate access to the first Action Set associated

7   with the rule.

1   27: The apparatus of claim 23, wherein each of the at least one Conditions includes

2   pattern, and an opcode; and

3   wherein the Rule Based Action Packet Processing Engine's is capable of, when

4   evaluating the Condition(s) in the Condition Set:

5   for each Condition,

6   comparing the pattern to the received packet in the manner dictated by the

7   opcode, and

8   producing a Boolean value as a result of the comparison; an

9   wherein determining if the Condition Set is met includes:

10   computing a single Boolean value utilizing the Boolean values resulting from

11   evaluating the Condition(s).

1   28: The apparatus of claim 27, wherein the Rule Based Action Packet Processing Engine

2   includes a 1-bit Condition Accumulator; and

3   the Rule Based Action Packet Processing Engine is capable of, when computing a single

4   Boolean value utilizing the Boolean values resulting from evaluating the Condition(s):

5   utilizing the 1-bit Condition Accumulator to logically AND, as each Condition's

6   Boolean value is computed, the Boolean values resulting from evaluating the

7   Condition(s).

1   29: The apparatus of claim 27, wherein the Rule Based Action Packet Processing Engine

2   is capable of, when determining if the Active Rule is met:

3   computing a single Boolean value utilizing the Boolean values resulting from

4   determining if the Condition Set is met.

1   30: The apparatus of claim 29, wherein the Rule Based Action Packet Processing Engine

2   includes a 1-bit Condition Set Accumulator; and

3   the Rule Based Action Packet Processing Engine is capable of, when computing a single

4   Boolean value utilizing the Boolean values resulting from determining if the Condition

5   Set is met:

6   utilizing the 1-bit Condition Set Accumulator to logically OR, as each Condition

7   Set's Boolean value is computed, the Boolean values resulting from determining if the

8   Condition Set is met.

1   31: The apparatus of claim 23, wherein the Rule Based Action Packet Processing Engine

2   is capable of

3   accessing the Condition Set Tables utilizing the Rule Group's field to facilitate

4   access to the first Condition Set associated with the rule

5   utilizing the Condition Set Table to access a Condition Indirection Table, having a

6   pointer to each Condition, wherein the pointers are grouped by Condition Set; and

7   utilizing the pointers to access a Condition Table having the Conditions; and

8   wherein the Condition Set Table is stored as a data structure within the cache memory.

1   32: The apparatus of claim 31, wherein Micro-Engine includes a Content Addressable

2   Memory (CAM); and

3   the Condition Indirection Table is stored within the Content Addressable Memory.

1   33: The apparatus of claim 23, wherein the Rule Based Action Packet Processing Engine

2   is capable of, when executing an Action Set associated with the Active Rule:

3   accessing an Action Set having at least one Action; and

4   executing each Action within the Action Set; and

5   the Action Set is stored a data structure within the cache memory.

1　34: The apparatus of claim 33, wherein the Rule Based Action Packet Processing Engine

2　is capable of performing one of the Actions selected from a group including the

3　following:

4　　　altering the packet header,

5　　　altering the packet contents,

6　　　reporting information to a third party, and

7　　　changing the priority status of the packet.

1　35: The apparatus of claim 33, wherein the Rule Based Action Packet Processing Engine

2　is capable of, when accessing an Action Set:

3　　　accessing a Rule Group having a pointer to the Action Set;

4　　　accessing an Action Set Table having a plurality of Action Sets; and

5　　　selecting an Action Set from the Action Set Table.

1　36: The apparatus of claim 23, wherein the number of Conditions in a Condition Set is

2　limited, at least in part, by the amount of information that can be read from a cache

3　memory in one clock cycle.

1　37: The apparatus of claim 23, wherein the number of Actions in an Action Set is

2　limited, at least in part, by the amount of information that can be read from the cache

3　memory in one clock cycle.

1   38: The apparatus of claim 35, wherein the cache memory includes a SRAM.

1   39: The apparatus of claim 38, wherein the packet buffer includes a DRAM.

1   40: The apparatus of claim 39, wherein the network processor core is further capable of

2   receiving instructions via a generic programmable interface; and

3   the received instructions are capable of altering the Condition Set and the Action

4   Set.

1   41: An article comprising:

2   a storage medium having a plurality of machine accessible instructions, wherein when the

3   instructions are executed, the instructions provide for:

4   receiving a packet;

5   applying an Active Rule to the received Packet;

6   accessing a cached Condition Set Table, having at least one Condition Set,

7   associated with the Active Rule;

8   for each Condition Set, having at least one Condition, in the Condition Set Table,

9   evaluating the Condition(s) in the Condition Set, and

10   determining if the Condition Set is met;

11   determining if the Active Rule is met; and

12   executing an Action Set associated with the Active Rule.

1   42: The article of claim 41, wherein the instructions providing for applying an Active

2   Rule to the received Packet includes instructions providing for:

3   parsing a cached Rules Tables, having a plurality of rules, to determine if a rule is

4   pertinent to the received packet;

5   if so, making the pertinent rule the Active Rule.

1   43: The article of claim 42, wherein the instructions providing for applying an Active

2   Rule to the received Packet includes instructions providing for:

3   if more than one rule in the Rules Table is pertinent, performing the method of

4   claim 1 for each pertinent rule.

1   44: The article of claim 42, wherein the received packet includes a source, a destination,

2   and a protocol;

3   wherein the rules in the Rules Table includes a source, a destination, and a

4   protocol; and

5   wherein the instructions providing for determining if a rule is pertinent to the

6   received packet includes instructions providing for:

7   determining if the source of the received packet and the source of the rule are equivalent;

8   determining if the destination of the received packet and the destination of the rule are

9   equivalent;

10   determining if the protocol of the received packet and the protocol of the rule are

11   equivalent;

12   if all three are equivalent, considering the rule pertinent to the received packet.

1   45: The article of claim 42, wherein the instructions providing for applying an Active

2   Rule to the received Packet includes instructions providing for:

3   selecting a rule from a Rules Table, having at least one rule; and

4   accessing a Rule Group from a Rules Group Table;

5   wherein the Rule Group includes a field to facilitate access to the first Condition Set

6   associated with the rule, and a field to facilitate access to the first Action Set associated

7   with the rule.

1   46: The article of claim 45, wherein the instructions providing for accessing a cached

2   Condition Set Table includes instructions providing for:

3   accessing the Condition Set Tables utilizing the Rule Group's field to facilitate

4   access to the first Condition Set associated with the rule.

1   47: The article of claim 41, wherein each of the at least one Conditions includes pattern,

2   and an opcode; and

3   wherein the instructions providing for evaluating the Condition(s) in the Condition Set

4   includes instructions providing for:

5   for each Condition,

6   comparing the pattern to the received packet in the manner dictated by the

7   opcode, and

8   producing a Boolean value as a result of the comparison; an

9   wherein determining if the Condition Set is met includes:

10   computing a single Boolean value utilizing the Boolean values resulting from

11   evaluating the Condition(s).

1   48: The article of claim 47, wherein each of the at least one Conditions further includes

2   at least one of the fields selected from a group including of the following:

3   a bit offset where the pattern is to be found,

4   a pattern mask to alter interpretation of the pattern,

5   a mask value to alter interpretation of received packet, and

6   a pattern length.

1   49: The article of claim 47, wherein each of the at least one Conditions further includes a

2   flag to denote that the Condition has already been evaluated for the current received

3   packet, and a value denoting the result of that evaluation.

1   50: The article of claim 47, wherein the instructions providing for computing a single

2   Boolean value utilizing the Boolean values resulting from evaluating the Condition(s)

3   includes instructions providing for:

4   utilizing a 1-bit Condition Accumulator to logically AND, as each Condition's

5   Boolean value is computed, the Boolean values resulting from evaluating the

6   Condition(s).

1   51: The article of claim 47, wherein the instructions providing for determining if the

2   Active Rule is met includes instructions providing for:

3   computing a single Boolean value utilizing the Boolean values resulting from

4   determining if the Condition Set is met.

1   52: The article of claim 51, wherein the instructions providing for computing a single

2   Boolean value utilizing the Boolean values resulting from determining if the Condition

3   Set is met includes instructions providing for:

4   utilizing a 1-bit Condition Set Accumulator to logically OR, as each Condition

5   Set's Boolean value is computed, the Boolean values resulting from determining if the

6   Condition Set is met.

1   53: The article of claim 46, wherein the instructions providing for evaluating the

2   Condition(s) in the Condition Set includes instructions providing for:

3   utilizing the Condition Set Table to access a Condition Indirection Table, having a

4   pointer to each Condition, wherein the pointers are grouped by Condition Set; and

5   utilizing the pointers to access a Condition Table having the Conditions.

1   54. The article of claim 53, wherein any Condition may be included by a plurality of

2   Condition Sets.

1   55. The article of claim 53, wherein the Condition Indirection Table is stored within a

2   Content Addressable Memory (CAM).

1   56. The article of claim 41, wherein the instructions providing for executing an Action

2   Set associated with the Active Rule includes instructions providing for:

3   accessing an Action Set having at least one Action; and

4   executing each Action within the Action Set.

1   57. The article of claim 56, wherein the instructions providing for executing each Action

2   includes instructions providing for performing one of the Actions selected from a group

3   including the following:

4   altering the packet header,

5   altering the packet contents,

6   reporting information to a third party, and

7   changing the priority status of the packet.

1   58. The article of claim 56, wherein the instructions providing for accessing an Action

2   Set having at least one Action includes instructions providing for:

3   accessing a Rule Group having a pointer to the Action Set;

4   accessing an Action Set Table having a plurality of Action Sets; and

5   selecting an Action Set from the Action Set Table.

1   59. The article of claim 41, wherein the number of Conditions in a Condition Set is

2   limited, at least in part, by the amount of information that can be read from a cache

3   memory in one clock cycle.

1   60. The article of claim 41, wherein the number of Actions in an Action Set is limited, at

2   least in part, by the amount of information that can be read from a cache memory in one

3   clock cycle.